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IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re the Application of: **Katsuya ITO et al.**

Group Art Unit: **1773**

Application Number: **10/568,615**

Examiner: **Vivian CHEN**

Filed: **September 18, 2006**

Confirmation Number: **9362**

For: **POLYESTER FILM**

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SUBMISSION OF SWORN TRANSLATION OF FOREIGN PRIORITY DOCUMENT

Mail Stop Amendment
Commissioner for Patents
P. O. Box 1450
Alexandria, VA 22313-1450

July 12, 2007

Sir:

Further to the Amendment filed June 29, 2007, attached hereto is a full English language translation of Applicants' Foreign Priority Document JP2003-295631. Also enclosed is a Declaration by the translator indicating that the translation is a true English language translation of the original document. Applicants' foreign priority document JP2003-295631 has a foreign filing date of August 19, 2003, which is earlier than the effective date of WO '611 as a reference.

If this paper is not timely filed, Applicants respectfully petition for an appropriate extension of time. The fees for such an extension or any other fees that may be due with respect to this paper may be charged to Deposit Account No. 50-2866.

Respectfully submitted,
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Enclosure: English translation of JP2003-295631



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: GROUP ART UNIT: 1773

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FOR: POLYESTER FILM

TRANSLATOR'S DECLARATION

Honorable Commissioner for Patents
P.O.Box 1450
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Sir:

I, Ritsuko Arimura, declare:

That I am well acquainted with both the Japanese and English languages;

That the attached document represents a true English translation of Japanese Patent Application No. 2003-295631 filed on August 19, 2003; and

That I further declare that all statements made herein of my own knowledge are true and that all statements made on information and belief are believed to be true; and further that these statements were made with the knowledge that willful false statements and the like so made are punishable by fine or imprisonment, or both, under Section 1001 of Title 18 of the United States Code and that such willful false statements may jeopardize the validity of the application or any patent issuing thereon.

Signed this 5th day of July, 2007.



Ritsuko Arimura



(Translation)

J A P A N P A T E N T O F F I C E

This is to certify that the annexed is a true copy of the
following application as filed with this Office.

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Application Number : 295631/2003
Applicant(s) : Toyo Boseki Kabushiki Kaisha

Commissioner, Japan Patent Office



【Document】 Petition for Patent

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【List of the Annexed Documents】

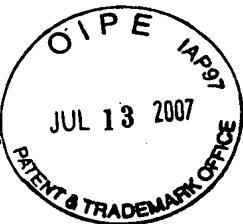
【Document】 Claims One copy

【Document】 Specification One copy

【Document】 Abstract One copy

【Number of General Power of Attorney】 9709127

[Document] Claims



[Claim 1]

A polyester film having an initial elastic modulus in at least one direction of 2.5-10 GPa, an impact strength of 40-
5 10000 J/mm, a thermal shrinkage in at least one direction at 150°C of -0.5% to 6%, a haze of 0.001% to 7%, and an absolute value of the difference in the thermal shrinkage between the longitudinal direction and the transverse direction of not more than 1.1%.

10 [Claim 2]

The polyester film of claim 1, which is made of a polyester resin composition comprising 10-90 wt % of polyethylene terephthalate resin (A), and 90-10 wt % of a polybutylene terephthalate resin and/or polytrimethylene
15 terephthalate resin (B).

[Claim 3]

The polyester film of claim 1 or 2, wherein the polyester film has a reduced viscosity of not less than 0.80.

[Claim 4]

20 The polyester film of claim 1, 2 or 3, wherein at least one surface of the film has at least one surface treatment layer selected from a coating layer, a corona discharge treatment layer, a vapor-deposited metal layer, a vapor-deposited inorganic oxide layer and an ink printed layer.

25 [Claim 5]

The polyester film of claim 1, 2, 3 or 4, which is used as a packaging material.

【Document】 Specification

【Title of the Invention】 Polyester Film

【Technical Field】

【0001】

5 The present invention relates to a polyester film superior in thermal dimensional stability and useful for various food packages, general industrial use, optical use, electric materials, mold processing use, a constituent material of film laminated metal plate and the like.

10 **【Background Art】**

【0002】

Films made from polyester represented by polyethylene terephthalate resin have been extensively applied to various uses in view of the mechanical property, heat resistance and 15 the like. However, they are not suitable for some uses because of the inferiority in flexibility and molding processibility. On the other hand, since films made from polyamide represented by 6-nylon are superior in flexibility, pinhole resistance and gas barrier property, they are applied to many uses such as 20 food packaging materials and the like. However, due to poor dimensional stability against moisture absorption, they cannot be easily applied to food packaging uses and industrial uses involving boiling treatment and retort treatment.

【0003】

25 Therefore, a polyester film having flexibility, which is one of the features of polyamide film, has been considered. Most of these films acquire flexibility based on the use of a polyester copolymer in a part or the entirety of the constituent resin. However, since they show degraded strength 30 and elastic modulus, which are mechanical properties, problems may occur during post-processing such as printing and the like.

【0004】

In view of the above, a flexible film made from crystalline polyester has been studied and, for example, films

comprising polyethylene terephthalate resin and polybutylene terephthalate resin are known (Patent References 1, 2, 3). In these films, prevention of the incidence of problems during post-processing has been tried by decreasing thermal shrinkage
5 by conducting heat setting after completion of biaxial orientation. Since the difference in the melting points between polyethylene terephthalate resin and polybutylene terephthalate resin is about 30°C, heat shrinkage cannot be suppressed sufficiently, which in turn necessitates many
10 limitations during post-processing.

【Patent reference 1】 JP-A-2002-037993

【Patent reference 2】 JP-A-2002-179892

【Patent reference 3】 JP-A-2002-321277

【Disclosure of the Invention】

15 【Problems to be Solved by the Invention】

【0005】

The present invention has been made in view of the problems of the above-mentioned conventional films, and provides a polyester film superior in mechanical strength, heat
20 resistance, chemical resistance, insulation property and thermal dimensional stability, and suitable for application to fields associated with boiling or retort treatment, which require tenacity, pinhole resistance, bending resistance, bag breakage resistance on dropping, impact resistance and the
25 like, fields requiring thermoforming or vacuum forming, and various uses such as packaging bags for water-containing food, pharmaceutical products and the like.

【Means of Solving the Problems】

【0006】

30 To achieve the above-mentioned object, the polyester film of the present invention has an initial elastic modulus in at least one direction of 2.5 - 10 GPa, an impact strength of 40 - 10000 J/mm, a thermal shrinkage in at least one direction at 150°C of -0.5 to 6%, a haze of 0.001 - 7%, and an absolute

value of the difference in the thermal shrinkage between the longitudinal direction and the transverse direction of not more than 1.1%.

[0007]

5 In this case, the polyester film may be made of a polyester resin composition comprising 10 - 90 wt% of polyethylene terephthalate resin A, and 90 - 10 wt% of a polybutylene terephthalate resin and/or polytrimethylene terephthalate resin B.

10 **[0008]**

In this case, the reduced viscosity of the polyester film may be not less than 0.80.

[0009]

15 In this case, at least one surface treatment layer selected from a coating layer, a corona discharge treatment layer, a vapor-deposited metal layer, a vapor-deposited inorganic oxide layer and an ink printed layer can be formed on at least one surface of the polyester film.

[0010]

20 In this case, the polyester film can be used as a packaging material.

[Effect of the Invention]

[0011]

The polyester film according to the present invention
25 is superior in mechanical strength, heat resistance, chemical resistance, insulation property and thermal dimensional stability, and can be applied to fields associated with boiling or retort treatment, which require tenacity, pinhole resistance, bending resistance, bag breakage resistance on
30 dropping, impact resistance and the like, fields requiring thermoforming or vacuum forming, and various uses such as packaging bags for water-containing food, pharmaceutical products and the like.

[Best Mode for Embodying the Invention]

[0012]

The polyester film of the present invention has an initial elastic modulus in at least one direction of 2.5 - 10 GPa, preferably 2.7 - 10 GPa, more preferably an initial 5 elastic modulus in the longitudinal direction and the transverse direction of 2.7 - 10 GPa. When it is less than 2.5 GPa, the film may be broken during high speed printing, printing displacement may occur and handling of the film in the form of a bag becomes difficult. When it exceeds 10 GPa, the 10 producibility of the film becomes poor.

[0013]

The polyester film of the present invention shows an impact strength of 40 - 10000 J/mm, preferably 60 - 1000 J/mm. When it is less than 40 J/mm, the film in the form of a bag 15 filled with the contents may gets broken when dropped and the like. When it exceeds 10000 J/mm, the producibility of the film becomes poor.

[0014]

The polyester film of the present invention has a 20 thermal shrinkage in at least one direction of -0.5% to 6%, preferably 0% to 3%, more preferably 0% to 1.5%. When it is lower than -0.5% or exceeds 6%, deformation of the film unpreferably occurs in the post-printing drying and the like.

[0015]

25 In addition, the polyester film of the present invention has a haze of 0.001% to 7%, preferably 0.01% to 5%. A haze of less than 0.001% is difficult to achieve in view of the production steps, and the production cost becomes high. When the haze exceeds 7%, visual appearance becomes defective 30 after back printing, thus posing problems in design.

[0016]

The polyester film of the present invention shows an absolute value of the difference in the thermal shrinkage between the longitudinal direction and the transverse direction

of not more than 1.1%, preferably not more than 0.9%, more preferably not more than 0.6%, further preferably not more than 0.3%. When it exceeds 1.1%, the gas barrier property after retort treatment may not be stabilized, or thermal stability
5 may be lost, which is unpreferable.

[0017]

The reduced viscosity (η_{sp}/c) of the polyester film of the present invention is preferably not less than 0.80, more preferably not less than 0.85, still more preferably not less
10 than 0.90. When it is less than 0.80, the impact strength decreases, and when the film is processed into a bag filled with the contents, bag breakage easily occurs.

[0018]

The thickness of the polyester film of the present
15 invention is generally 3 - 1000 μm , preferably 3 - 100 μm , more preferably 5 - 70 μm .

[0019]

The polyester film of the present invention is preferably made of a polyester resin composition containing 10
20 - 90 wt% of polyethylene terephthalate resin A, and 90 - 10 wt% of a polybutylene terephthalate resin and/or polytrimethylene terephthalate resin B. The polyester resin composition contains polyethylene terephthalate resin A (hereinafter sometimes to be abbreviated as resin A) in a proportion of 10 -
25 90 wt%, preferably 15 - 70 wt%, more preferably 20 - 49 wt%, and a polybutylene terephthalate resin and/or polytrimethylene terephthalate resin B (hereinafter sometimes to be abbreviated as resin B) in a proportion of 90 - 10 wt%, preferably 85 - 30 wt%, more preferably 80 - 51 wt%. When resin A is contained in
30 a proportion of less than 10 wt%, stretchability becomes poor due to the fast crystallization rate of resin B, causing easy breakage during film forming, and when resin A is contained in a proportion of more than 90 wt%, flexibility becomes insufficient. When resin B is contained in a proportion of

less than 10 wt%, flexibility becomes insufficient, and when resin B exceeds 90 wt%, stretchability of the film becomes poor due to the fast crystallization rate of resin B, causing easy breakage during film forming.

5 【0020】

The polyethylene terephthalate resin A to be used in the present invention preferably has a reduced viscosity of 0.55 - 1.20, more preferably 0.55 - 0.80. When the reduced viscosity is smaller than this range, a film having practical 10 mechanical strength cannot be obtained easily, and when it exceeds this range, the film forming property of the film is unpreferably degraded.

【0021】

The polyethylene terephthalate resin A to be used in 15 the present invention is preferably made of a homopolymer mainly comprising terephthalic acid and ethylene glycol. As long as the heat resistance and other properties are not impaired, it may be a polyester copolymer wherein not more than 20 mol%, preferably 0.1 - 10 mol%, of a different acid 20 component or a glycol component is copolymerized.

【0022】

When the polyethylene terephthalate resin to be used in the present invention is a copolymer, the following monomers can be used as a copolymerizable component.

25 【0023】

As the dicarboxylic acid usable for copolymerization, aromatic dicarboxylic acid is exemplified by isophthalic acid, orthophthalic acid, naphthalene dicarboxylic acid, biphenyl dicarboxylic acid and the like. Examples of aliphatic 30 dicarboxylic acid include succinic acid, adipic acid, azelaic acid, sebacic acid, dodecanedioic acid, dimer acid and the like, and examples of alicyclic dicarboxylic acid include 1,4-cyclohexane dicarboxylic acid, 1,3-cyclohexane dicarboxylic acid, 1,2-cyclohexane dicarboxylic acid, acid anhydride thereof

and the like. Examples of dicarboxylic acid containing a polymerizable unsaturated double bond include α,β -unsaturated dicarboxylic acid (e.g., fumaric acid, maleic acid, maleic anhydride, itaconic acid, citraconic acid), alicyclic 5 dicarboxylic acid containing an unsaturated double bond (e.g., 2,5-norbornene dicarboxylic anhydride, tetrahydrophtalic anhydride) and the like.

[0024]

As the glycol usable for copolymerization, aliphatic 10 glycol having 3 to 10 carbon atoms, alicyclic glycol having 6 to 12 carbon atoms and ether bond-containing glycol and the like can be mentioned. As the aliphatic glycol having 3 to 10 carbon atoms, 1,2-propylene glycol, 1,3-propanediol, 1,4-butanediol, 1,5-pentanediol, neopentyl glycol, 1,6-hexanediol, 15 3-methyl-1,5-pentanediol, 1,9-nonanediol, 2-ethyl-2-butylpropanediol and the like can be mentioned. As the alicyclic glycol having 6 to 12 carbon atoms, 1,4-cyclohexanedimethanol and the like can be mentioned.

[0025]

20 Further, as the ether bond-containing glycol, polyethylene glycol, polypropylene glycol, polytetramethylene glycol, diethylene glycol, triethylene glycol, dipropylene glycol, glycals obtained by adding ethyleneoxide or propyleneoxide to two phenolic hydroxyl groups of bisphenols 25 (e.g., 2,2-bis(4-hydroxyethoxyphenyl)propane) and the like can be mentioned.

[0026]

In addition, the polybutylene terephthalate resin and/or polytrimethylene terephthalate resin B to be used in the 30 present invention preferably has a reduced viscosity of 0.80 - 2.20. When the intrinsic viscosity is smaller than this range, a film having practical mechanical strength cannot be obtained easily, and when it exceeds this range, the film forming property of the film is unpreferably degraded.

【0027】

The polybutylene terephthalate resin to be used in the present invention is preferably made of a homopolymer mainly comprising terephthalic acid and butanediol. As long as the
5 heat resistance and other properties are not impaired, it may be a polyester copolymer wherein not more than 20 mol%, preferably not more than 10 mol%, of a different acid component or a glycol component is copolymerized. In addition, the polytrimethylene terephthalate resin is preferably made of a
10 homopolymer mainly comprising terephthalic acid and trimethylene glycol. As long as the heat resistance and other properties are not impaired, it may be a polyester copolymer wherein not more than 220 mol%, preferably 0.1 - 10 mol%, of a different acid component or a glycol component is
15 copolymerized.

【0028】

When the polybutylene terephthalate resin or polytrimethylene terephthalate resin to be used in the present invention is a copolymer, the following monomers can be used as
20 a copolymerizable component.

【0029】

As the dicarboxylic acid usable for copolymerization, various dicarboxylic acids can be mentioned. Of these, examples of aromatic dicarboxylic acid include isophthalic
25 acid, orthophthalic acid, naphthalene dicarboxylic acid, biphenyl dicarboxylic acid and the like. Examples of aliphatic dicarboxylic acid include succinic acid, adipic acid, azelaic acid, sebacic acid, dodecanedioic acid, dimer acid and the like, and examples of alicyclic dicarboxylic acid include 1,4-
30 cyclohexane dicarboxylic acid, 1,3-cyclohexane dicarboxylic acid, 1,2-cyclohexane dicarboxylic acid, acid anhydride thereof and the like. Examples of dicarboxylic acid containing a polymerizable unsaturated double bond include α,β -unsaturated dicarboxylic acid (e.g., fumaric acid, maleic acid, maleic

anhydride, itaconic acid, citraconic acid), alicyclic dicarboxylic acid containing an unsaturated double bond (e.g., 2,5-norbornene dicarboxylic anhydride, tetrahydrophtalic anhydride) and the like.

5 【0030】

As the glycol usable for copolymerization, aliphatic glycol having 2 to 10 carbon atoms, alicyclic glycol having 6 to 12 carbon atoms, ether bond-containing glycol and the like can be mentioned. As the aliphatic glycol having 2 to 10
10 carbon atoms, ethylene glycol, 1,2-propylene glycol, trimethylene glycol, 1,4-butanediol, 1,5-pantanediol, neopentyl glycol, 1,6-hexanediol, 3-methyl-1,5-pantanediol, 1,9-nonanediol, 2-ethyl-2-butylpropanediol and the like can be mentioned. As the alicyclic glycol having 6 to 12 carbon
15 atoms, 1,4-cyclohexanedimethanol and the like can be mentioned.

【0031】

Furthermore, as the ether bond-containing glycol, polyethylene glycol, polypropylene glycol, polytetramethylene glycol, diethylene glycol, triethylene glycol, dipropylene
20 glycol, glycals obtained by adding ethylene oxide or propylene oxide to two phenolic hydroxyl groups of bisphenols (e.g., 2,2-bis(4-hydroxyethoxyphenyl)propane etc.) and the like can be mentioned.

【0032】

25 The polyester film of the present invention can contain any amount of fine particles in a polyester resin composition constituting the polyester film. For example, silicon dioxide, kaolin, clay, calcium carbonate, calcium terephthalate, aluminum oxide, titanium oxide, calcium phosphate, silicone
30 particles and the like can be mentioned, with preference given to inorganic lubricants. During melt mixing, additives such as stabilizer, coloring agent, antioxidant, antifoaming agent, antistatic agent and the like can be added as necessary besides lubricant.

【0033】

The polyester film of the present invention should have mechanical strength in order to stably conduct post-processing such as formation of a surface treatment layer such as a coating layer, a surface activation treated layer, a vapor-deposited metal layer, a vapor-deposited inorganic oxide layer and a printed ink layer and the like. For this end, polyethylene terephthalate resin A, and polybutylene terephthalate resin and/or polytrimethylene terephthalate resin B constituting the polyester film preferably do not allow copolymerization during melt extrusion. As a method for suppressing copolymerization, (1) a method comprising adding a particular phosphorus compound to suppress transesterification reaction, (2) a method comprising controlling the size of the resin pellets to be mixed so as to prevent smooth mixing, (3) a method comprising lowering the temperature of extruder to prevent easy progression of transesterification, (4) a method comprising using an extruder having a double flight type screw so as to prevent smooth mixing of resin A and resin B, (5) a method comprising melt extrusion of resin A and resin B from two extruders each, mixing them in a molten state immediately before extruding from a T-die and then extruding the mixture from the T-die and the like can be mentioned.

【0034】

When a phosphorus compound is added to suppress copolymerization of polyethylene terephthalate resin A and a polybutylene terephthalate resin and/or polytrimethylene terephthalate resin B during melt extrusion, it is preferable, but not limited, to use a phosphorus compound having a melting point of not less than 200°C and a molecular weight of not less than 200. While the optimal amount of addition varies depending on the kind of the phosphorus compound, polymerization conditions and the like, addition in a proportion of 0.01 - 0.3 wt% is preferable for the suppression

of transesterification reaction between resin A and resin B. For use for food such as beverage can and the like, the compound and amount thereof should meet the standard of FDA (U.S. Food and Drug Administration), Japan Hygienic Olefin and 5 Styrene Plastics Association and the like. To increase crystallization rate, it is also preferable to add a substance to be a nucleating agent for crystallization, while suppressing copolymerization.

【0035】

10 The substance to be a nucleating agent for crystallization can be added after mixing with a plasticizer such as polyethylene, polypropylene, polystyrene, polyester polymer or polyester copolymer having a molecular weight of not more than 20000, which has the aforementioned monomer 15 constitution, fatty acid ester and the like. As the nucleating agent for crystallization, inorganic particles of calcium carbonate, non-crystalline zeolite particles, anatase type titanium dioxide, rutile type titanium dioxide, calcium phosphate, silica, kaolin, talc, clay, barium sulfate, zinc 20 oxide, zinc sulfide and the like can be mentioned, which are generally added in a proportion of 0.001 - 2 wt%, preferably 0.01 - 1 wt%. However, the results thereof vary drastically depending on the substances to be added, the amount of addition, means of addition, order of addition, particle size 25 and the like, as well as the melt extrusion conditions of the film. Thus, for stable expression of the effect, it is preferable to employ a method comprising preparing master batch pellets by the addition of inorganic particles during polymerization to a polyester copolymer having a molecular 30 weight of not more than 20000 and having the aforementioned monomer constitution, dry blending the pellets with at least the pellets of resin A and resin B to be the substrate or master batch pellets, and melting and extruding the mixture. As compared to the addition of inorganic particles to resin A

and resin B during polymerization, dispersibility in a resin mixture becomes fine, which, it is considered, in turn increases crystallization rate and suppresses whitening of polyester film during boiling, retort treatment and
5 thermoforming.

[0036]

In addition, it is preferable to control the size of the resin pellets to be mixed, so as to suppress copolymerization of the polyethylene terephthalate resin A, and
10 a polybutylene terephthalate resin and/or polytrimethylene terephthalate resin B during melt extrusion.

[0037]

It is also preferable to set the temperature of each part to not more than 270°C, preferably not more than 262°C,
15 during the period of from mixing and melting of the resins, passage through an extruder, to extrusion from a T-die, so as to suppress copolymerization of the polyethylene terephthalate resin A, and a polybutylene terephthalate resin and/or polytrimethylene terephthalate resin B during melt extrusion.
20 The presence of a temperature zone exceeding 270°C in a melt extrusion step is considered to accelerate decomposition of a polyester usable as resin B, which in turn promote copolymerization of resin A and resin B. When the film of the present invention is to be produced using a single extruder, in
25 the melt extrusion step, resin A, resin B and other resin pellets constituting the aforementioned polyester resin composition are mixed, cast in an extruder, melted, extruded from a T-die, adhered to a cooling roll by an electrostatic adhesion method and the like, and solidified by cooling to give
30 a non-oriented sheet. In this case, the temperature of an extruder is preferably set to not more than 270°C, preferably not more than 262°C, for all of the feeding part, compression part, measuring part, filter, resin flow path and T-die of the extruder.

[0038]

In general, when the extrusion temperature conditions for resin are described in literatures, the resin temperature immediately before entry of the resin into a T-die or
5 immediately after delivery of the resin from the T-die is often taken as the temperature condition of extrusion. Control of only the resin temperature immediately before entry into a T-die or immediately after delivery from the T-die is insufficient to definitely control the resin temperature during
10 the melt extrusion step up to the T-die. It is a general practice to intentionally change the feeding part, compressing part, measuring part, filter and resin flow path of an extruder, in view of the specific condition of the machine, such as screw shape of the extruder and the like, production
15 speed and stability, and the temperature of the respective parts is in fact often different from each other.

[0039]

Furthermore, when the film of the present invention is to be produced using a single extruder, so as to suppress
20 copolymerization of polyethylene terephthalate resin A, and a polybutylene terephthalate resin and/or polytrimethylene terephthalate resin B during melt extrusion, a uniaxial extruder having a double flight type screw compression part (compression zone), which is of a rapid compression type with a
25 small compression ratio (not more than 2.0) is preferably used. As an extruder having a double flight type screw, UB series manufactured by Mitsubishi Heavy Industries, Ltd. can be mentioned.

[0040]

30 To suppress copolymerization of polyethylene terephthalate resin A, and a polybutylene terephthalate resin and/or polytrimethylene terephthalate resin B during melt extrusion, moreover, resin A and resin B are respectively melted and extruded from two extruders, mixed in a molten state

and immediately thereafter extruded from a T-die to give the film of the present invention. As a method for mixing in a molten state immediately before extrusion from a T-die, a method comprising feeding respective molten resins in a molten 5 state to molten resin mixers such as extruders, static mixers and the like, melt-mixing and extruding them, and the like can be mentioned. As a device for mixing molten resins, conventional uniaxial extruder, biaxial extruder, dynamic mixer, static mixer (manufactured by Noritake Co., Limited and 10 the like) and the like can be mentioned. As a preferable method for suppressing copolymerization of polyethylene terephthalate resin A and polytrimethylene terephthalate resin B during melt extrusion, the above-mentioned method (5), and a combination of method (5) and other method can be mentioned.

15 **[0041]**

While the polyester film of the present invention can be used when it meets the requirements of a non-oriented sheet of the present invention, it can be preferably obtained by orienting a non-oriented sheet at least uniaxially, more 20 preferably biaxially or more. The method of orientation includes tubular orientation, pantographic simultaneous biaxial orientation, linear motor simultaneous or sequential biaxial orientation, sequential biaxial orientation based on a combination of a heating roll and a tenter and the like. In 25 the case of sequential biaxial orientation, orientation methods of longitudinal-transverse, transverse-longitudinal, longitudinal-longitudinal-transverse, longitudinal-transverse-longitudinal, longitudinal-transverse-transverse, longitudinal-longitudinal-longitudinal-transverse and the like can be 30 mentioned.

[0042]

The production method of the film of the present invention is shown below by referring to a sequential biaxial orientation method as an example. Resin chips of polyethylene

terephthalate resin A, and a polybutylene terephthalate resin and/or polytrimethylene terephthalate resin B are mixed, cast into one extruder, melted, mixed and extruded. The mixture is extruded from a T-die and the melt extruded sheet is
5 electrostatically adhered to a chill roll to give a non-oriented sheet. The temperature of the chill roll then is preferably 10 - 40°C. When the temperature of the chill roll exceeds 40°C, the polybutylene terephthalate resin and/or polytrimethylene terephthalate resin B crystallize to whiten
10 the extruded sheet. As a result, haze after biaxial orientation becomes poor and the printed layer becomes difficult to see.

[0043]

The obtained non-oriented sheet is delivered to a pair
15 of orienting rolls at 50 - 100°C with different speeds, drawn 2.5 to 5-fold in the longitudinal direction. The longitudinally oriented sheet is delivered to a tenter and drawn 2.5 to 5-fold in the transverse direction at 60 - 120°C. Where necessary, the sheet may be drawn in the longitudinal
20 direction and the transverse direction in two steps at different temperature and different folding rate. Then, the sheet is heat set at 180 - 230°C to give a polyester film.

[0044]

The polyester film of the present invention shows not
25 more than 1.1% of the difference in the absolute value of thermal shrinkage between the longitudinal direction and the transverse direction. To obtain such a polyester film, the film forming conditions are controlled. According to a conventional sequential biaxial orientation method, thermal
30 shrinkage is suppressed by heat setting *in situ* in the tenter after completion of the second axial orientation, while relaxing the sheet in the transverse direction. However, since relaxing in the longitudinal direction at this point is difficult, thermal shrinkage in the longitudinal direction and

that in the transverse direction often becomes different. In the present invention, a method of relaxing in the longitudinal direction with the clips of the tenter, or a method of relaxing the sheet after leaving the tenter using heating rolls having 5 different rotation speeds is preferably employed. Since the relaxing conditions vary depending on the orientation ratio, speed and the like, individual conditions are determined. Generally preferably, the heat setting temperature is 180 - 230°C, the relaxing rate is 2 - 8%, the difference in the heat 10 setting temperature between the longitudinal direction and the transverse direction is not more than 20°C, and the difference in the relaxing rate between the longitudinal direction and the transverse direction is within 2% (e.g., when the relaxing rate in the transverse direction is set for 4% that in the 15 longitudinal direction is set to 2 - 6%).

【0045】

The polyester film of the present invention can have at least one surface treatment layer selected from a coating layer, a surface activation treated layer, a vapor-deposited 20 metal layer, a vapor-deposited inorganic oxide layer and a printed ink layer on at least one surface thereof,. In the present invention, these layers may be formed on one surface of the film or both surfaces thereof, which can be appropriately determined according to use. The absolute value of the 25 difference in the thermal shrinkage between the longitudinal direction and the transverse direction of the polyester film having such a surface treatment layer is not more than 1.1%, preferably not more than 0.9%, more preferably not more than 0.6%, and still more preferably not more than 0.3%. When it 30 exceeds 1.1%, gas barrier property after retort treatment may become unstable and the thermal stability may be lost, which are unpreferable.

【0046】

In the present invention, a coating agent for forming a

coating layer on at least one surface of a polyester film is not particularly limited as long as it has adhesiveness. Examples thereof include coating agents made of polyester resin, polyurethane resin, polyacryl resin, polyvinyl alcohol 5 resin and copolymers thereof, ethylene-vinyl acetate copolymer resin and the like. To improve adhesion between a polyester film and ink, a vapor-deposited layer and the like, a polyester resin coating agent is preferably used. One-component or two-component polyurethane resin coating agents are also 10 preferable. Specific examples of the two-component polyurethane coating agent include product name Takerak A2027 and Takenate A3 (both manufactured by Takeda Pharmaceutical Company Ltd.). As the polyester resin coating agent, product name VYLON (manufactured by Toyo Boseki Kabushiki Kaisha) can 15 be mentioned.

【0047】

In the present invention, a coating layer can contain fine particles, antistatic agent, surfactant, antioxidant, light shielding agent, antigelling agent and the like. As the 20 fine particles, for example, inorganic particles having a particle size of about 0.01 - 10 μm , such as calcium carbonate, sedimentary barium carbonate, silica, talc and the like, and organic particles such as polystyrene, polyester, melamine, benzoguanamine, acrylic particles and the like can be 25 mentioned.

【0048】

In the present invention, when a coating layer is to be formed on at least one surface of a polyester film, a preferable method preferably comprises applying a coating 30 solution to a uniaxially oriented sheet, and feeding the sheet to a tenter and drawing the sheet in the perpendicular direction, thereby simultaneously preventing degradation of film forming stability and transparency, maintaining water resistance of the coating layer, preventing delamination and

breakage of vapor-deposited film during boiling treatment, and preventing degradation of gas barrier property after boiling treatment. In this case, it is preferable to apply a coating solution to a uniaxially oriented sheet, dry the sheet and then 5 lead the sheet to a tenter. Since the polybutylene terephthalate resin and the polytrimethylene terephthalate resin show a faster crystallization rate as compared to a polyethylene terephthalate resin, the transverse orientation temperature and the preheating temperature before that need to 10 be set higher, when the coating solution is led to a tenter without drying, which causes easy occurrence of whitening due to crystallization (high haze) and breakage of the film. Therefore, a coating layer is preferably dried at not less than 40°C and not more than 70°C after coating. When it exceeds 15 70°C, crystallization of uniaxially oriented sheet begins, which easily cause whitening and breakage. When it is less than 40°C, drying tends to become insufficient.

【0049】

As a method for forming a coating layer in the present 20 invention, conventional coating methods can be used. For example, gravure coating, micro gravure coating, bar coating, reverse roll coating, reverse kissroll coating, comma coating, dam coating, curtain coating, dip coating, blade coating and the like can be employed.

25 【0050】

In addition, a surface activation treated (e.g., corona discharge treatment) layer can be formed on at least one surface of the polyester film of the present invention. Since such surface modification means modification of the polar group 30 on the film surface, the wetting property of the film surface can be improved, and when the wetting tension of the surface of the surface activation treated layer is set to not less than 35 dyne/cm, ink absence during printing can be reduced.

【0051】

A vapor-deposited metal layer can be formed on at least one surface of the polyester film of the present invention. As a metal preferable for forming a vapor-deposited metal layer, aluminum, palladium, zinc, nickel, gold, silver, copper,
5 indium, tin, chrome, titanium and the like can be mentioned. Representatively, aluminum is used.

【0052】

A vapor-deposited inorganic oxide layer can be formed on at least one surface of the polyester film of the present
10 invention. As an inorganic oxide preferable for forming a vapor-deposited inorganic oxide layer in the present invention, any can be used as long as a vapor-deposited layer of an inorganic oxide, which shows transparency and gas barrier property, can be formed. Metal oxides and nonmetal oxides are
15 widely used, and particularly, a vapor-deposited layer comprising silicon oxide and/or aluminum oxide as main components is preferable.

【0053】

While the film thickness of the vapor-deposited layer
20 of a metal or inorganic oxide is not limited and may be any, it is within the range of generally 10 - 5000 Å, more preferably 50 - 2000 Å.

【0054】

A vapor-deposited layer of a metal or inorganic oxide
25 can be formed by physical vapor deposition methods such as vacuum vapor deposition, sputtering, ion plating and the like, chemical vapor deposition methods such as CVD and the like, and the like as appropriate. As a heating method employed here, resistance heating, induction heating, electron beam heating
30 and the like can be employed as appropriate. As a reaction gas, oxygen, nitrogen, hydrogen, argon, carbon gas, water vapor and the like can be introduced, or reactive vapor deposition using ozone addition, ion assist etc. may be employed. In addition, bias may be applied to a substrate, and film forming

conditions such as heating and cooling of a substrate, may be changed. Such vapor deposition material, reaction gas, substrate bias, and heating and cooling conditions can be changed in the same manner when performing sputtering or CVD.

5 The surface of a vapor deposited substrate may be subjected to a corona discharge treatment, a flame treatment, a low temperature plasma treatment, a glow discharge treatment, a reverse sputtering treatment, a surface roughening treatment and the like, before or during vapor deposition with a metal or

10 inorganic oxide, thereby still more increasing the adhesion strength of a metal or inorganic oxide effectively.

【0055】

In addition, the polyester film of the present invention can have a printed ink layer formed on at least one 15 surface thereof. As the printing ink used for forming a printed ink layer is one generally used, such as an ink comprising a coloring material comprising a pigment or dye, a binder and a volatile organic solvent as constituent components. When light, particularly UV, is to be blocked with 20 the printed ink layer, an ink layer having UV blocking property is formed. A printed ink layer can be formed by any method from gravure printing, offset printing, screen printing or other printing method, which is determined according to the film thickness, size, continuous or sheet feeding, and the 25 like. Most generally, a printed ink layer is formed on a continuous film by gravure printing or offset printing.

【0056】

In general, after forming a printed ink layer on a polyester film, a thermally adhesive resin layer is laminated 30 or applied on a surface opposite to the surface in contact with the polyester film of the printed ink layer. After printing, therefore, a method comprising continuously laminating a thermally adhesive resin layer is most efficient and advantageous in terms of cost.

【0057】

The polyester film of the present invention can be effectively utilized for use for which a nylon film is conventionally employed, which is specifically a food packaging material requiring pinhole resistance and bag breakage resistance, particularly, a food packaging material for fish processed products involving a boiling treatment or a retort treatment, pickles, daily dishes, livestock meat processed products and the like, based on the superiority of polyester in the heat resistance and moisture absorption dimensional stability. Moreover, it can be effectively utilized as packaging for industrial materials such as infusion pack, semiconductor, pet food, agricultural chemicals, fertilizers, precision equipment and the like, as well as medical, electronic, agricultural, mechanical products and the like. In addition, it can be effectively utilized as a material of packaging involving vacuum forming and air pressure forming, such as molded containers and the like, and a material of cards and electronic equipment cases, taking advantage of heat resistance, impact resistance and crystallization properties.

【Examples】

【0058】

The present invention is explained in detail in the following by referring to Examples. Each property value in the present invention was measured as shown below.

【0059】

1. Reduced viscosity

Reduced viscosity (η_{sp}/c)

A polymer (0.125 g) was dissolved in phenol/tetrachloroethane = 6/4 (weight ratio) (25 mL) and measurement was performed at 25°C with a Ubbelohde viscometer. The unit was dL/g. The resin was in the form of chips, and the film was cut finely and used for the measurement.

【0060】

2. Initial elastic modulus

The measurement was performed according to JIS-K7127-1989 using Autograph (manufactured by Shimadzu Corporation: AG-5000A).

5 【0061】

3. Thermal shrinkage

A sample was cut into 10 mm X 150 mm, and gauge lines were marked at 100 mm intervals on 10 sample pieces. They were left standing in a gear oven at 150°C for 30 min. without a
10 load, after which they were taken out and the distance between gauge lines was measured at room temperature. The values were determined according to the following formula and an average value of 10 sample pieces was taken as the thermal shrinkage (%) of each sample.

15 【0062】

$$\text{thermal shrinkage} = ((A-B)/A) \times 100$$

A: distance between gauge lines before heating

B: distance between gauge lines after heating

【0063】

20 4. Difference in thermal shrinkage

An absolute value (%) of the difference between the values of thermal shrinkage in the longitudinal direction of the film and that in the transverse direction thereof was taken as the difference in the thermal shrinkage.

25 【0064】

$$\text{difference in thermal shrinkage} = |C-D|$$

C: thermal shrinkage in the longitudinal direction

D: thermal shrinkage in the transverse direction

【0065】

30 5. Haze

The measurement was performed based on JIS-K-7105-1981 and using a turbidity meter (manufactured by Nippon Denshoku Industries Co., Ltd.: NDH2000), and the value of haze (HZ) shown thereon was used.

【0066】

6. Impact strength

Using a film impact tester (manufactured by Toyo Seiki Seisaku-sho, LTD.: serial number T-84-3), a measurement film was pressed with a clamp, thrust a 1/2 inch diameter hemisphere impacting head thereinto, and the impact strength of the sample was measured. Ten film samples were prepared, and the impact strength was measured for 5 films at a time, changing the surface to be subjected to the impact. The sample was cut into 100 mm X 100 mm or more, and the ring that pressed the sample had an inner diameter of 30 mm. Average values of the impact strength of sample pieces were determined, and converted to those per 1 mm of thickness to give the impact strength (J/mm) of the film.

15 【0067】

7. Gas barrier property

As a vapor deposition source, particles (about 3 - 5 mm in size) of Al₂O₃ (purity 99.5%) and SiO₂ (purity 99.9%) were used. An adhesion modification layer having a solid content of 20 0.3 g/m² (layer formed by applying a mixture of a polyester resin aqueous dispersion (100 parts by weight, manufactured by Toyo Boseki Kabushiki Kaisha: MD1200: solid content 30 wt%), methyl melamine (40 parts by weight, manufactured by Sumitomo Chemical Co., Ltd.: M-30W), water (410 parts by weight) and 25 isopropyl alcohol (50 parts by weight) with a wire bar and drying at 160°C for 1 min) was formed on only one surface of the polyester films obtained in Examples and Comparative Examples. The films were fed to a vacuum vapor deposition apparatus. The inside of the chamber was maintained at a 30 pressure of 1.5 X 10⁻⁵ Torr, and a mixture of inorganic oxides of SiO₂ (70 wt%) and Al₂O₃ (30 wt%) was evaporated by electron beam heating (15 kw) to form a colorless, transparent vapor-deposited inorganic layer having a thickness of 220 Å on the adhesion modification layer.

Thereafter, the oxygen transmission rate was measured using an oxygen transmission rate measurement apparatus (manufactured by ModernContorols: OX-TRAN 10/50A) at humidity 50%, temperature 25°C, wherein the unit was mL/(m²·MPa·24hours).

5 The water vapor transmission rate was measured using a water vapor transmission rate measurement apparatus (manufactured by ModernContorols: PERMATRAN) at humidity 0%, temperature 25°C, wherein the unit was g/(m²·24hours). In view of food packaging, an oxygen level of not more than 50 mL/(m²·MPa·24 hours) was

10 accepted and water vapor of not more than 5.0 g/(m²·24 hours) was accepted.

【0068】

8. Gas barrier property after retort treatment

A sample was treated in an autoclave at 125°C for 30 min., left standing at 23°C, RH 65% for 24 hr and the oxygen transmission rate and the water vapor transmission rate were measured in the same manner as above. In view of food packaging, an oxygen level of not more than 50 mL/(m²·MPa·24 hours) was accepted and water vapor of not more than 10 g/(m²·24 hours) was accepted.

【0069】

9. Whitening after retort treatment

After the test of 8, a fine appearance free of whitening was marked with O and whitened appearance with 25 insufficient transparency was marked with x.

【0070】

10. Vision of printed matter

Using a three-color gravure printer manufactured by Modern Machinery, Ltd., blue, red and white of gravure ink "UNIVURE A" manufactured by Dainippon Ink and Chemicals Incorporated were sequentially printed on one surface of the obtained polyester film having a vapor-deposited layer or coating layer by gravure printing, and when the vision from the back was clear, O was indicated and when the vision was not

clear, x was indicated. The printing was performed at a rate of 50 m/min, drying temperature 90°C.

【0071】

11. Bag dropping test

As a sealant film, a nonoriented polypropylene film (manufactured by Toyo Boseki Kabushiki Kaisha: P1153: 50 μm) was dry laminated on the obtained polyester film, and four sides were sealed with an impulse sealer. Ten bags (150 mm X 150 mm) containing water were produced, subjected to a retort treatment at 125°C for 30 min. The bags were dropped 20 times from a height of 1 m at 5°C. The average number of droppings before incidence of bag breakage or water leakage was employed. Preferably, the number is not less than 10, more preferably not less than 15. When it is less than 10, practical problems are caused in the transportation of packages.

【0072】

(Example 1)

Polyethylene terephthalate resin (A1) (reduced viscosity 0.75) comprising 2000 ppm of silicon dioxide (F) (manufactured by FUJI SILYSIA CHEMICAL LTD.: Silysia 310) previously added during polymerization was prepared as resin A, polybutylene terephthalate resin (B1) (reduced viscosity 1.20) and polybutylene terephthalate resin (B2) (reduced viscosity 1.10) comprising 1% of an organic phosphorus compound (manufactured by ASAHI DENKA Co., Ltd.: Adeka Stub PEP-45) were prepared as resin B, and polyester polymer (C1) which is terephthalic acid/sebacic acid//ethylene glycol/1,4-butanediol (90/10//60/40 (molar ratio), molecular weight 2000) previously comprising 2% of talc (D) (average particle size by electron microscope method 3.5 μm) during polymerization was prepared as polyester C. They were cast into a single screw extruder (screw 65φ: UB manufactured by MITSUBISHI HEAVY INDUSTRIES, LTD.) at A1/B1/B2/C1 = 40/56/2/2 (parts by weight). For temperature setting of the extruder, temperatures of a feeding

part (Ex1), a compressing part (Ex2), a measuring part (Ex3), the flow path up to a filter, the filter part, the flow path up to a die, and the die of the extruder were set, where Ex1 was 240°C, from Ex2 to the filter part was 260°C, and thereafter
5 was 255°C, and resins were supplied. The temperature of the resins measured immediately after extrusion from the T-die was 258°C. A 200 mesh filter was used. The resins extruded from the T-die was rapidly cooled on a roll cooled to 20°C according to an electrostatic adhesion method to give a non-oriented
10 sheet having a thickness of about 200 μm . The sheet was supplied to a roll drawing machine, and drawn 3.3-fold in the longitudinal direction at 63°C. Subsequently, the sheet was transversely drawn 3.5-fold at 90°C in a tenter, and heat set
15 *in situ* at 210°C in the tenter while relaxing by 3% in the transverse direction. The film was further led to rolls having a rotation speed difference, and heat set at 220°C in the tenter while relaxing by 3% in the longitudinal direction to give a film having a thickness of 21 μm .

【0073】

20 In addition, an adhesion modification layer was formed on one surface of the obtained polyester film to give a polyester film having, on its surface, a colorless and transparent vapor-deposited layer made of a mixed inorganic oxide of SiO_2 and Al_2O_3 and having a thickness of 220 Å. The
25 properties of the obtained film were evaluated and are shown in Table 1 and Table 2.

【0074】

(Comparative Example 1)

In the same manner as in Example 1 except that, after
30 heat setting in the transverse direction, the rate of relaxation in the longitudinal direction using rolls having a rotation speed difference was set to 0.02%, a polyester film and a polyester film having a vapor-deposited layer were obtained. The properties of the obtained films were evaluated

and the results are shown in Table 1 and Table 2.

【0075】

(Example 2)

In the same manner as in Example 1 except that, after
5 heat setting in the transverse direction, the rate of
relaxation in the longitudinal direction using rolls having a
rotation speed difference was set to 2%, a polyester film and a
polyester film having a vapor-deposited layer were obtained.
The properties of the obtained films were evaluated and the
10 results are shown in Table 1 and Table 2.

【0076】

(Example 3)

In the same manner as in Example 1 except that, after
heat setting in the transverse direction, the rate of
15 relaxation in the longitudinal direction using rolls having a
rotation speed difference was set to 4%, a polyester film and a
polyester film having a vapor-deposited layer were obtained.
The properties of the obtained films were evaluated and the
results are shown in Table 1 and Table 2.

20 【0077】

(Comparative Example 2)

In the same manner as in Example 1 except that, after
heat setting in the transverse direction, the rate of
relaxation in the longitudinal direction using rolls having a
25 rotation speed difference was set to 10%, production of a
polyester film was tried. However, wrinkles were developed on
the film during film formation, and the property values could
not be measured.

【0078】

30 (Example 4)

In the same manner as in Example 1 except that the
mixing ratio of respective resins was set to A1/B1/B2/C1 =
75/21/2/2 (parts by weight), a polyester film and a polyester
film having a vapor-deposited layer were obtained. The

properties of the obtained films were evaluated and the results are shown in Table 1 and Table 2.

【0079】

(Example 5)

5 In the same manner as in Example 1 except that the mixing ratio of respective resins was set to A1/B1/B2/C1 = 25/71/2/2 (parts by weight), a polyester film and a polyester film having a vapor-deposited layer were obtained. The properties of the obtained films were evaluated and the results
10 are shown in Table 1 and Table 2.

【0080】

(Example 6)

In the same manner as in Example 1 except that polytrimethylene terephthalate having a reduced viscosity of
15 0.83 was used instead of polybutylene terephthalate, a polyester film and a polyester film having a vapor-deposited layer were obtained. The properties of the obtained films were evaluated and the results are shown in Table 1 and Table 2.

【0081】

20 (Comparative Example 3)

In the same manner as in Example 1 except that the rate of the longitudinal orientation was set to 2.5-fold and the rate of the transverse orientation was set to 2.5-fold, a polyester film and a polyester film having a vapor-deposited
25 layer were obtained. The properties of the obtained films were evaluated and the results are shown in Table 1 and Table 2.

【0082】

(Comparative Example 4)

In the same manner as in Example 1 except that the temperature
30 of Ex1, Ex2, Ex3 and the flow path up to the filter, the filter part, the flow path up to the die, and the die of the extruder was set to 290°C for all of them, a polyester film and a polyester film having a vapor-deposited layer were obtained. The properties of the obtained films were evaluated and the

results are shown in Table 1 and Table 2.

[0083]
[Table 1]

	reduced viscosity (dL/g)	initial elastic modulus (GPa) (longitudinal/transverse)	thermal shrinkage (%) (longitudinal/transverse)	difference (%) in thermal shrinkage (longitudinal-transverse)	haze (%)	appearance after printing
Ex. 1	0.85	2.7/2.8	0.5/0.3	0.2	3.8	O
Comp. Ex. 1	0.84	2.7/3.1	2.5/0.5	2.0	3.5	O
Ex. 2	0.84	2.8/2.9	0.8/0.4	0.4	3.2	O
Ex. 3	0.84	2.8/2.9	0.4/0.2	0.2	3.2	O
Comp. Ex. 2	0.84	Wrinkles were developed during film formation, and measurement was unavailable.				
Ex. 4	0.89	3.8/4.2	0.9/0.3	0.6	3.9	O
Ex. 5	0.97	3.0/3.1	0.5/0.4	0.1	3.8	O
Ex. 6	0.85	3.1/3.2	0.7/0.5	0.2	3.2	O
Comp. Ex. 3	0.84	1.5/1.5	1.3/1.1	0.2	3.5	x printing displacement occurred
Comp. Ex. 4	0.71	2.3/2.2	0.8/0.4	0.4	3.2	O

[0084]

[Table 2]

thermal shrinkage (%) after vapor deposition retort treatment (longitudinal/ transverse)	haze (%) after whiten- ing	bag drop test (times)	polyester film		after retort treatment		impact strength (J/mm)		
			oxygen trans- mission rate	water vapor transmission rate	oxygen trans- mission rate	water vapor transmission rate			
Ex. 1	0.3/0.1	4.1	O	17	15	1.5	17	3.3	71
Comp. Ex. 1	1.4/0.2	3.6	O	2	21	2.6	178	not less than 20	70
Ex. 2	0.3/0.1	3.3	O	17	15	1.5	17	1.4	72
Ex. 3	0.3/0.1	3.4	O	17	16	1.5	18	2.1	73
Comp. Ex. 2	Wrinkles were developed during film formation, and measurement was unavailable.						74		
Ex. 4	0.3/0.1	3.9	O	14	17	1.5	17	2.1	55
Ex. 5	0.3/0.1	3.9	O	17	12	1.5	18	2.2	80
Ex. 6	0.3/0.1	3.3	O	17	17	1.5	19	1.9	71
Comp. Ex. 3	0.2/0.2	3.6	O	16	21	2.6	25	5.6	92
Comp. Ex. 4	0.3/0.1	3.3	x	3	15	1.5	178	not less than 20	28

Unit: oxygen transmission rate mL/(m²·MPa·24 hours), water vapor transmission rate g/(m²·24 hours)

【0085】

While the polyester film of the present invention has been described based on plural Examples in the above, the present invention is not limited to the constitutions described 5 in the Examples above, but rather, various changes may be made to the constitution as appropriate without departing from the gist of the present invention, such as appropriate combination of the constitutions described in respective Examples and the like.

10 [Industrial Applicability]

【0086】

As mentioned above, since the polyester film of the present invention is characteristically superior in mechanical strength, heat resistance, chemical resistance, insulation 15 property and thermal dimensional stability, it can be preferably used for the fields associated with boiling or retort treatment, which require tenacity, pinhole resistance, bending resistance, bag breakage resistance on dropping, impact resistance and the like, fields requiring thermoforming or 20 vacuum forming, and uses such as packaging bags for water-containing food, pharmaceutical products and the like.

【Document】 Abstract

【Summary】

【Problem】 Provision of a polyester film superior in mechanical strength, heat resistance, chemical resistance, insulation property and thermal dimensional stability, and suitable for application to fields associated with boiling or retort treatment, which require tenacity, pinhole resistance, bending resistance, bag breakage resistance on dropping, impact resistance and the like, fields requiring thermoforming or vacuum forming, and various uses such as packaging bags for water-containing food, pharmaceutical products and the like.

【Solving Means】 The polyester film characteristically shows an initial elastic modulus in at least one direction of 2.5 - 10 GPa, an impact strength of 40 - 10000 J/mm, a thermal shrinkage in at least one direction at 150°C of -0.5% to 6%, a haze of 0.001% to 7%, and an absolute value of the difference in the thermal shrinkage between the longitudinal direction and the transverse direction of not more than 1.1%.

【Main Drawing】 none

20